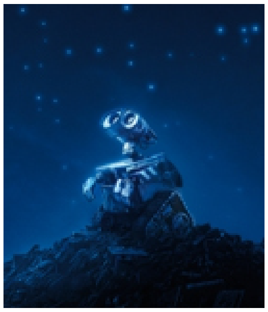
Navigation Plan: Earth to Moon



Team name: Team AstROOnaut

Spacecraft name: Wall-e-ROO

Launch time and date: January 26th, 2009 (Australia Day)

Duration of Journey: 98 days approximately. We got this number based on a 3 day flight from the Earth to the Moon (like Apollo flights) and then the spacecraft doing a slingshot around the Moon and into an LGALRO orbit. Each LGALRO orbit takes 38 days and 2 ½ orbits are needed. That makes the total travel time 98 days.

Description of Route and Orbital Path: Launch is from Cape Canaveral. Once the spacecraft is on the opposite side to the moon, the rocket boosters are fired to go into the transfer orbit to the moon. The escape velocity that is needed to be reached is 7 miles per second or about 25,000 miles per hour.
Using the gravity of the Moon and Earth, the spacecraft will slingshot into an LGALRO orbit. This orbit is needed because it is faster and higher energy than the one used by the Apollo crews. This orbit uses less fuel and is a highly elliptical orbit going around both the Earth and the Moon.
After 98 days, the spacecraft will have a high energy impact almost perpendicular to the lunar surface. This angle allows lots of Moon dust to fly everywhere. Also we want to smash into the Moon, not go into orbit around the Moon and land on it.

Navigation Instruments: Earthlings can monitor the spacecraft's path and velocity with radio signals. A Deep Space Network of giant radio antennas use something called Doppler Shift. Computers on the spacecraft and on Earth are also used.

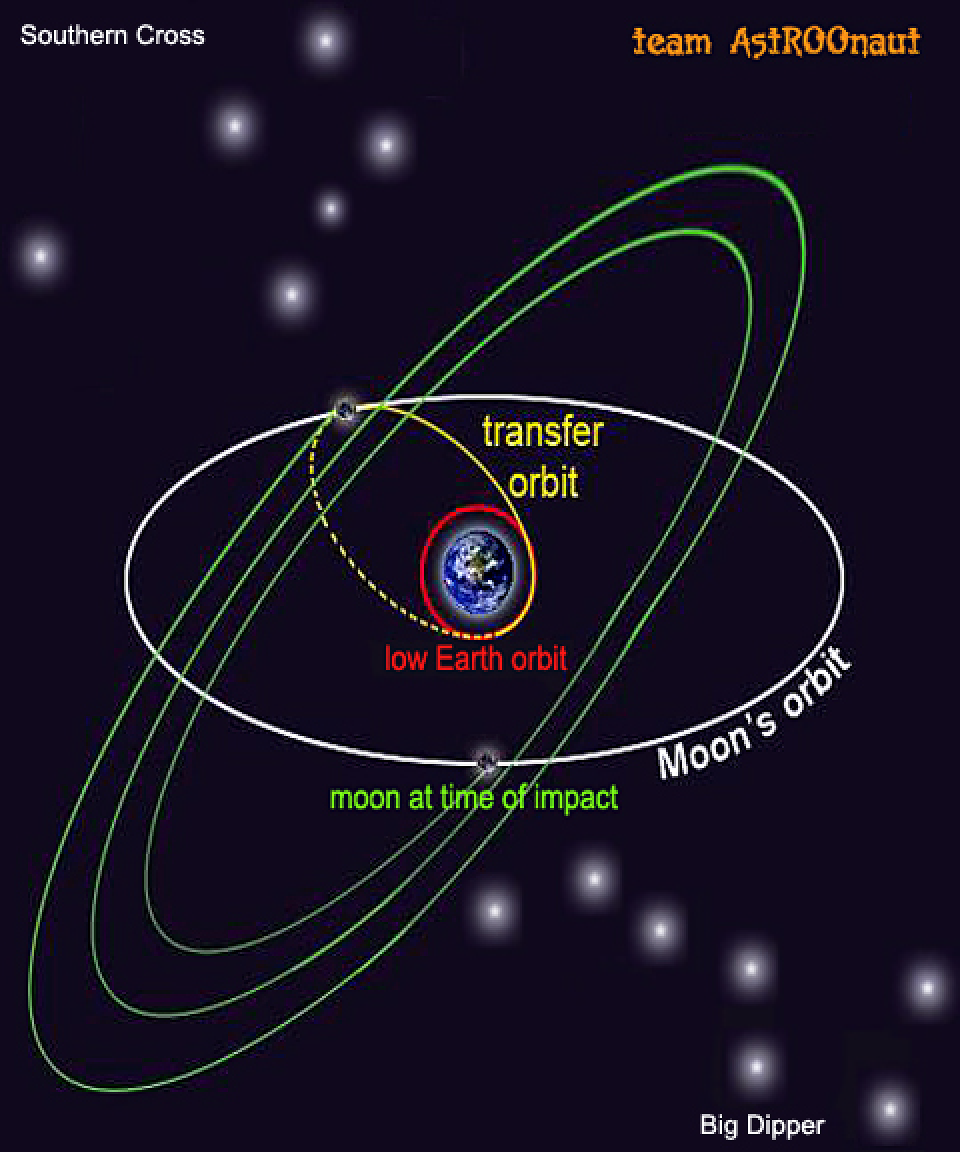
Methods of guidance, navigation, control, and tracking: Radio signals are sent from the Moon-bound spacecraft and are received on Earth by giant radio antennas called the Deep Space Network.
The speed of the craft is calculated using Doppler shift. Doppler shift is the apparent change in frequency of the sound or light waves emitted by the spacecraft measured from antennas on Earth.
The spacecraft's position in the sky can be calculated by two or more antennas at DSN stations at opposite ends of the Earth. The antennas make recordings of the spacecraft's radio signals, then they are turned towards a quasar (whose location is known with accuracy) and by comparing the two radio signals can determine the spacecrafts location in the sky.
Accurately knowing the spacecraft's position and velocity, NASA can decide whether on not to make corrective firings of the rockets onboard the spacecraft. If the rockets need to be fired, NASA can relay the information needed to fire the rockets via the DSN.

OFF COURSE

Problem: LCROSS will miss target crater by 10 kilometers. Eight hours before impact, the corrective thrusters must be fired.

This solution is based on no rounding and using Customary units measurement.

Solution: The two formulas I used to solve the problem are: F = M*G and V = A*T
G = 32.174049   F = 10 lb   W = 7,275 lb
To find the mass of the spacecraft I used the formula   M = W/G
M = 7,275 lb/32.174049 ft/s which equals 226.1139094 slugs
To find the acceleration of the spacecraft I used the formula   A = F/M
A = 10 lb/226.1139094 slugs which equals 0.044225496 ft/s
I need to change the spacecraft's trajectory by 10 km over an 8 hour period. This can be written as delta-V = 1.25 km/h
Then I need to change kilometers to feet using this formula   3,280.8399 feet = 1 km
Delta-V = 1.25 km/1 h*3,280.8399 ft/1 km which equals 4,101.04988 ft'hr
Then I need to convert hours to seconds using this formula   1 h = 3,600 s
Delta-V = 4,101.04988 ft/1 h*1 h/3,600 s which equals 1.139180525 ft/s
Finally I need to figure out the amount of time I need to fire the thrusters for, using the formula   T = V/A
1.139180525 feet per second/0.044225496 which equals 25.75845667 seconds, which is how long I need to fire the thrusters for to correct the course of the craft by 10 kilometers.


Southern Cross
team AstROOnaut
transfer
orbit
low Earth orbit
Moon's orbit
moon at time of impact
Big Dipper